G A L O R A T H

DCMC Pricing and Negotiation Conference

"Paying The Right Price" Through Parametric Estimation Modeling
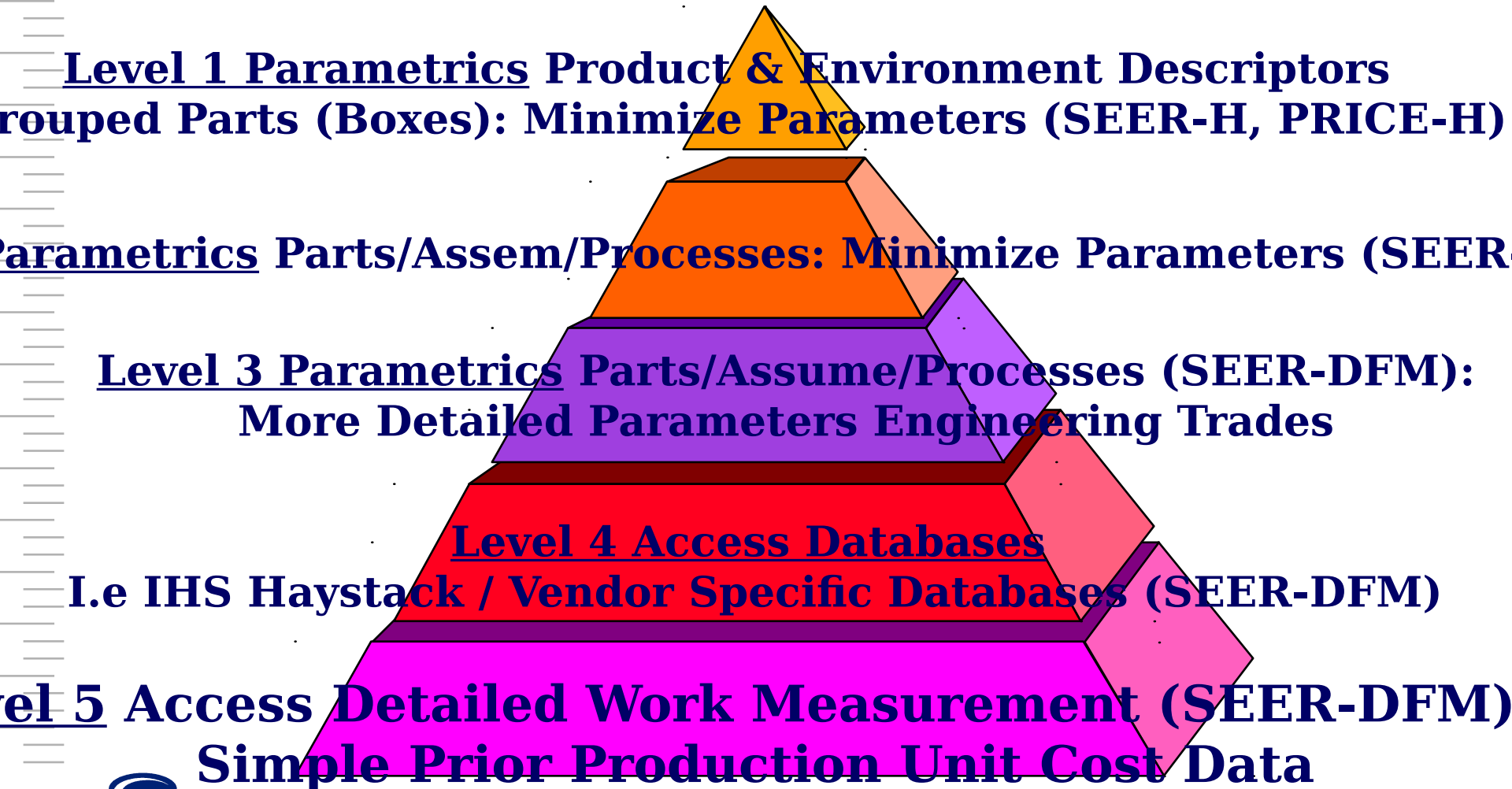
Dan Galorath, June 2000

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Two Kinds of Parametrics Models

- **Macro level Parametrics (SEER-H, PRICE-H)**
- **Estimates Based On High Level Information Such As Weight, Boards, Etc.**
- **Quicker than Manual Methods**
- **Able To Estimate Without Cost Data**
  - Development, Production, Logistics, Operations, & Support All Handled In One Model (SEER-H)
  - Can Be Calibrated Against Actuals

- **Detailed Level Parametrics (SEER-DFM)**
- **To Understand "Should Cost" Tradeoffs & Potential Reductions**
- **Models Specific Manufacturing Issues**
  - Details Including Specific Assembly Issues, Specific Materials, Process Selection, etc. (Insertion Methods)
  - Often Called Bottoms Up Parametrics
  - Cost Based On The Work That Must Be Performed
  - Cost Tradeoffs Based On Very Specific Manufacturing Issues (These Cannot Be Fully Understood By Calibration of Macro Level "H" Models)
  - Much More Rapid Piece Parts Quotes From Subs
  - Repeatable

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Cost Model Input Parameter Granularity Must Address Estimating Requirements

Level 1 Parametrics Product & Environment Descriptors Grouped Parts (Boxes): Minimize Parameters (SEER-H, PRICE-H)

Parametrics Parts/Assem/Processes: Minimize Parameters (SEER-

Level 3 Parametrics Parts/Assume/Processes (SEER-DFM): More Detailed Parameters Engineering Trades

Level 4 Access Databases I.e IHS Haystack / Vendor Specific Databases (SEER-DFM)

Level 5 Access Detailed Work Measurement (SEER-DFM) Simple Prior Production Unit Cost Data

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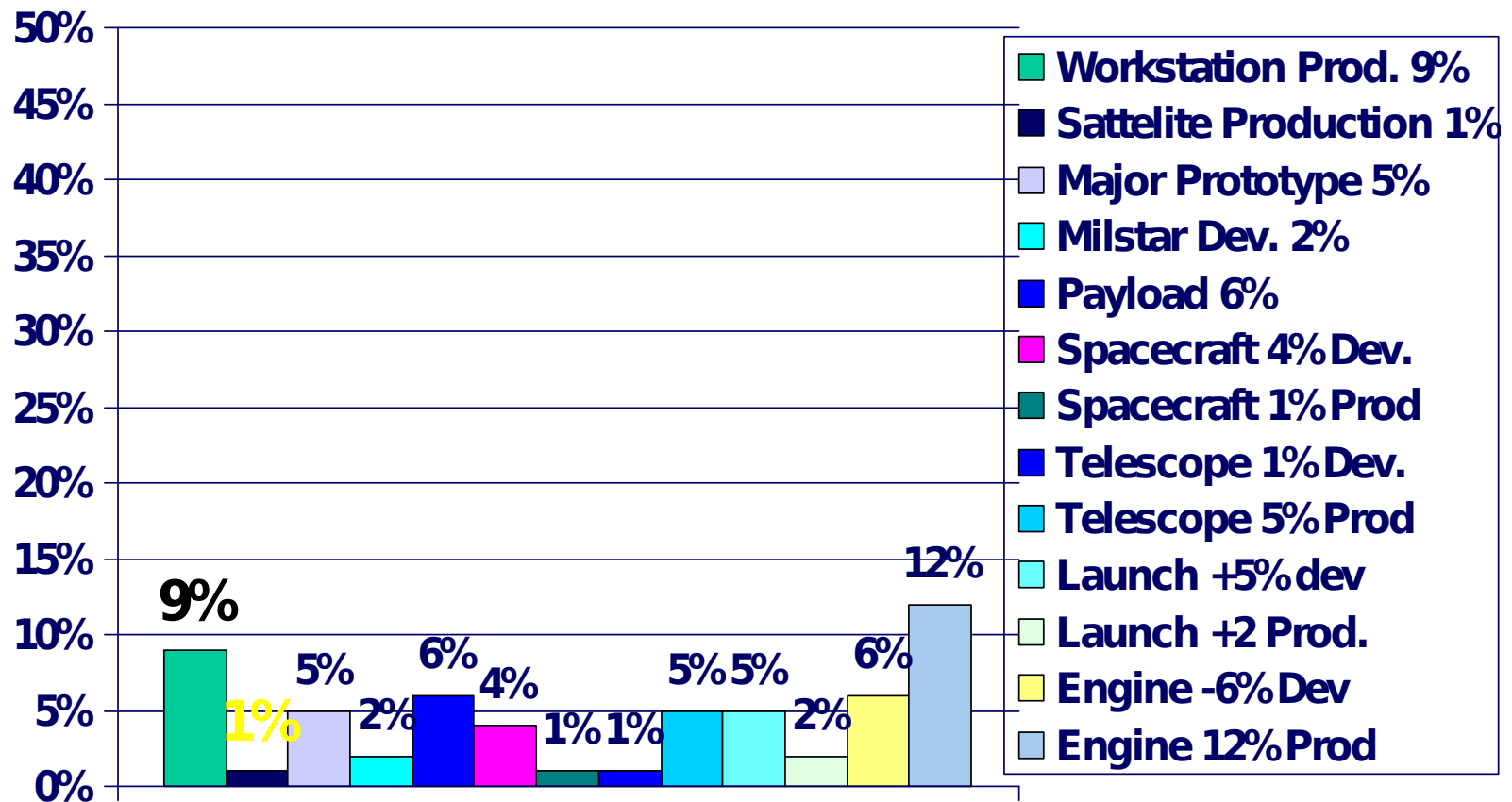
Parametrics As A Basis Of Negotiation Example

- **Buying Organization's Estimate Was $130,000 Less Than Bid For A Part**
- **Contractor Was Asked To Justify the Cost Difference**
- **Contractor Was Unable To Do So**
- **Result... $130,000 Reduction In Price**
- **Why Did This Work**
  - Buying Organization Had Experience With SEER Model
    - Found Accurate In Estimating
    - Buying Organization Was Able To Model Part Specific Characteristics
  - The Buyer and Supplier Were Able To View The Problem In Terms Of Its Characteristics

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SEER-H Provides Accurate System Estimates

Legend:
- ■ Workstation Prod. 9%
- ■ Sattelite Production 1%
- ■ Major Prototype 5%
- ■ Milstar Dev. 2%
- ■ Payload 6%
- ■ Spacecraft 4% Dev.
- ■ Spacecraft 1% Prod
- ■ Telescope 1% Dev.
- ■ Telescope 5% Prod
- ■ Launch +5% dev
- ■ Launch +2 Prod.
- ■ Engine -6% Dev
- ■ Engine 12% Prod

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+ PRODUCT DESCRIPTION
-   Material Origin                          Sand Casting
-   Production Quantity                         2,000
-   Quantity Per Next Higher Assembly              1
-   Hourly Labor Rate                          54.00
-   Production Experience/Optimization    Low       Hi        EHi
-   Manufacturing Environment                  Consumer
-   Material Selection                     Grey Cast Irons
-   Raw Sandcast Part Cost (Optional)          0.0000
-   Finished Weight (lb)           300.0000  340.0000  380.0000
-   Shape                          Irregular Cross Section
-   Dimensions (in)                  0.000     0.000
+ OPERATIONS
-   Mill Locating Pad (Radial Mill Rough)
-   Rough Front Mtg. Flg (End Mill Rough)
-   Finish Front Mtg Flg (End Mill Finish)   0.0100      0.00
-   Drill Mtg Holes (Drill)                      7     0.7500
-   Tap Mtg Holes (Tap)                          7
-   Bore Pilot Hole (Bore Finish)           0.0050      0.00
-   Drill Holes (Drill)                         19     1.2500
-   Tap Holes (Tap)                             11
-   Ream Holes (Ream)                            8
-   Operation (Next)
+ MANUFACTURING DESCRIPTION
-   Tooling Type                      Hi        Hi
-   Tooling Complexity               Low       Low
-   Machine Tool Condition           Nom       Nom
+ OPTIONAL COST INPUTS
-   Tooling Cost (Optional)                  2,500.00
-   Tooling Amort. Quantity (Optional)          5,000
-   Other Cost (Optional)                      700.00
+ LABOR CALIBRATION                             1.00
-   Start Learning (Optional)                  10,000
-   Stop Learning (Optional)                        0
-   PROBABILITY (RISK)                         50.00%
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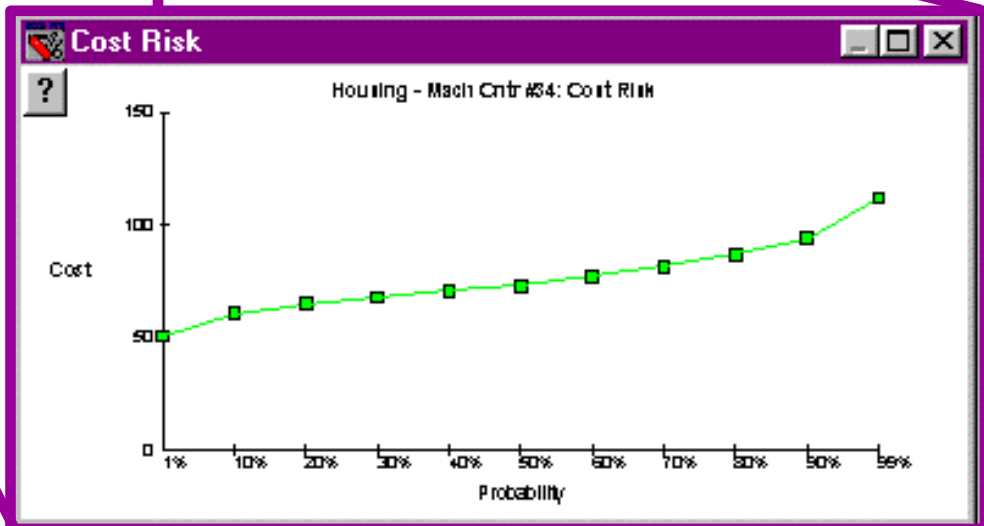
Cost Risk

Housing – Mach Cntr #34: Cost Risk

Cost vs. Probability

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Macro Level "H" Models Vs Part Specific Model
One Boeing Seattle Prospective

- **Boeing Seattle Finds Using Both "H" Models And SEER-DFM They Get The Full Cost Picture and Save The Government Money**

- **Macro Level H Models Start With High level Information Such As Weight and General Material Type**
  - Output Cost, Labor, Materials, O&S Costs
  - Even With Calibration, Macro Level "H" Models Can't Do The Detailed Engineering/Cost Tradeoffs

- **Use SEER-DFM For Trades & Detailed Analysis**
  - Example: Part Weighed 25 pounds
  - Driving Out 1.5 pounds (Sculpt With Spars) Quadrupled cost
  - SEER-DFM Able To Accurately Model This
  - Answers Questions Such As "How many do you have to produce before a process makes sense?"
  - Macro Level "H" models" Can't Answer Such Questions Without Infinite Calibrations And Data Often Not Available

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DCMC Boeing Seattle Comments On Using The SEER-DFM Parametric Approach:

- **This Is What We Are Looking For. It simplifies The negotiation. The Parameters Define The Part. Easier to negotiate change**
  - SEER-DFM breaks down to detail so both sides think it is fair
  - Works For Simple Manufacturing Processes & Complicated Parts & Processes
  - Using SEER-DFM They Tradeoff Of Specific Materials, Processes, Fasteners, Stiffeners, Assembly, Even That Don't Impact The Weight
  - All Cost Relationship Data Resides in SEER-DFM
- **Government Audits The Parts, Process, Assembly, Specifics, Not $ Just Per Pound**
- **Tradeoffs Are Performed Based On Specific, Controllable Variables (SEER-DFM Parameters)**

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Lessons learned

- **Part of the Process Is To Obtain Buy-In From Both Government and Contractor IN Advance of Use In Negotiation**
- **Use The Right Type of Parametric Model For The Job At Hand**
- **Many Times an "H" Model Will Be Sufficient**
    - When Part Has Been Done Before
    - When There Is No Change In Environment
    - When The Production Issues Are Simple/Expected
    - When Specific Engineering Tradeoffs Are Not Needed
- **Other Times Complex Operations For Parts Will Require A Part/Process/Assembly Model Like SEER-DFM**
    - When The Part Has Unusual Complexity I.E.
        - Specific Assembly Challenges
        - Custom Manufacturing Processes
        - When Should Cost Means Find A Lower Cost

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